HP Apollo 8000 System

Monitoring and Controls

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HP Apollo 8000 System

Leading performance density

HP Apollo f8000 Rack

Dry disconnect server trays

HP ProLiant XL730f
2x2P Servers

HP ProLiant XL740f
2P+ 2 Accelerators

HP ProLiant XL750f
2P+2 GPUs

HP InfiniBand Switch for
Apollo 8000 System

Efficient liquid cooling without the risk

HP Apollo 8000 iCDU Rack

HP Apollo 8000 Cooling Circuit

Apollo 8000 System Technologies

Advancing the science of supercomputing

Intelligent Cooling Distribution Unit

- 320 KW power capacity
- Integrated controls with active-active failover

Dry-disconnect servers

- 100% water cooled components
- Designed for serviceability

Management infrastructure

- HP iLO4, IPMI 2.0 and DCMI 1.0
- Rack-level Advanced Power Manager

Warm water

- Closed secondary loop in CDU
- Isolated and open facility loop

Power infrastructure

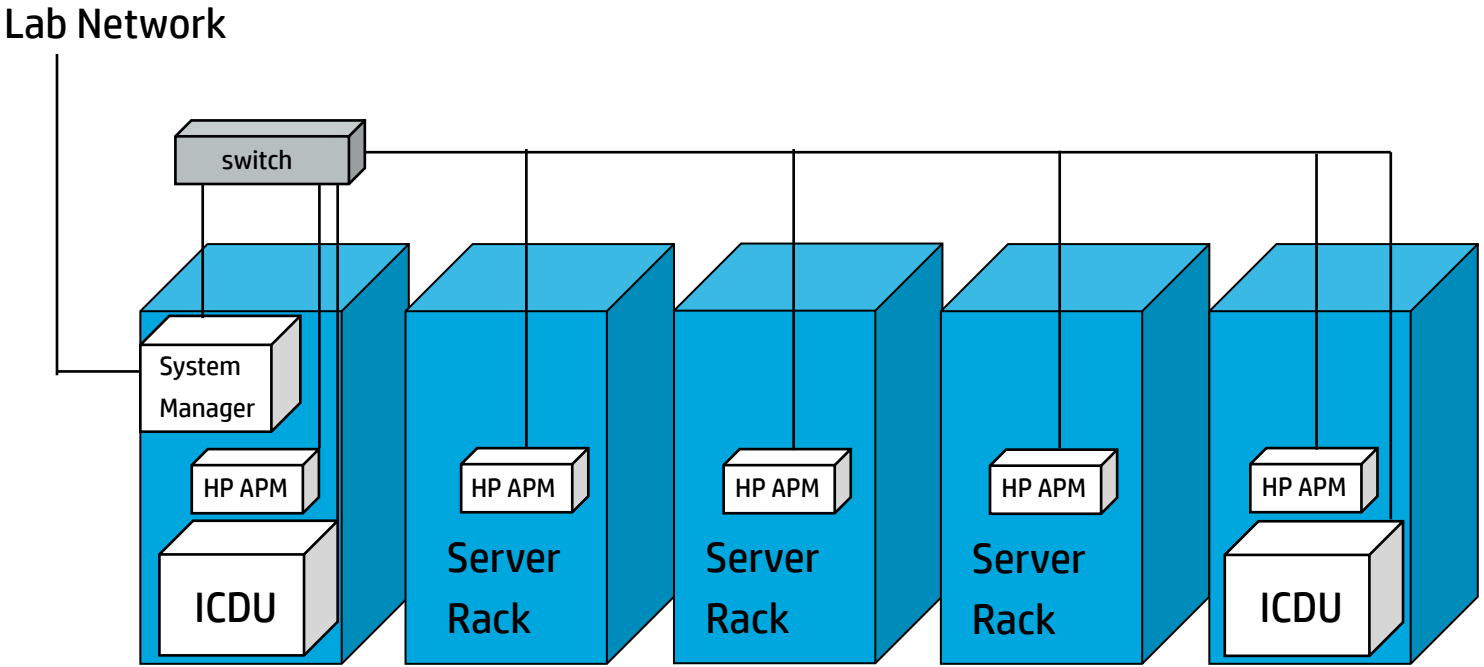
- Up to 80kW per rack
- Four 30A 3-phase 380-480VAC

Open door view of 4 f8000, redundant iCDU racks and underfloor plumbing kit

HP System Manager v1.0 Objectives

- **Provide insight into the Apollo 8000 water-cooled infrastructure**
- **Provide solution-level and component-level views**
- **Display sensor history for trending and analysis**
- **Send email when alerts are detected**

HP System Manager network topology



HP System Manager

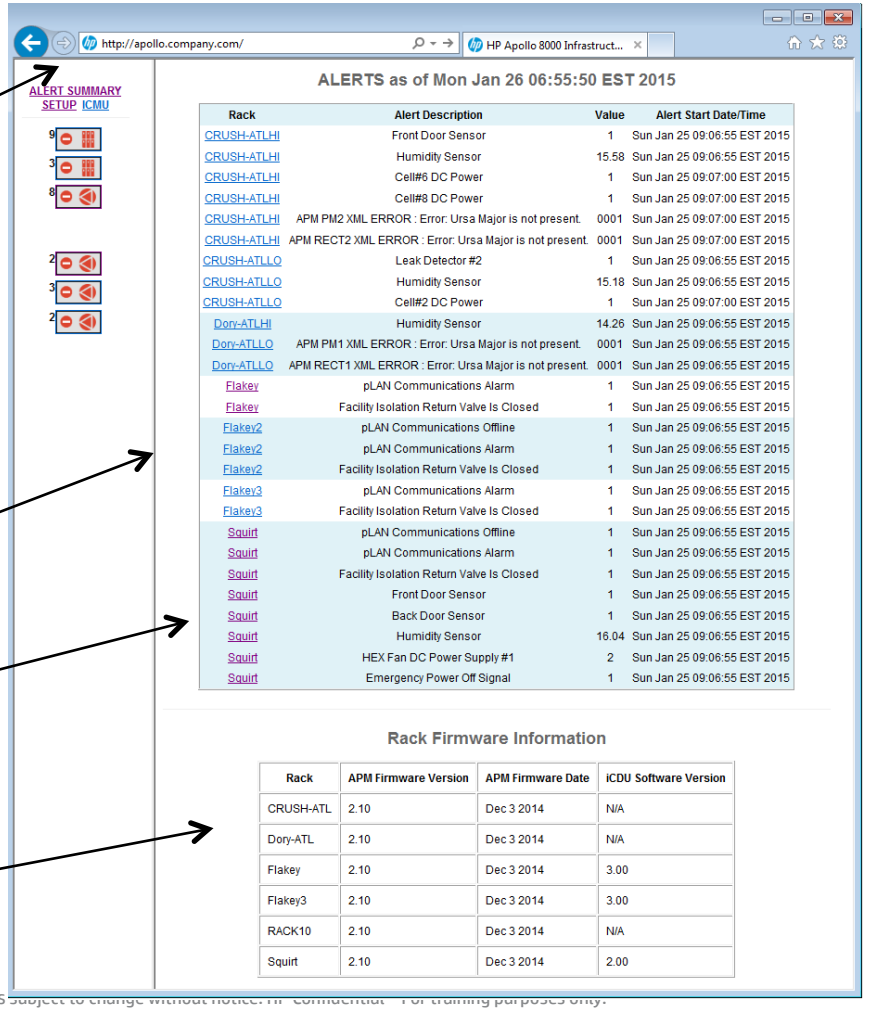
Launch the Main Display

All racks are displayed and colored based on alert summary

All current alerts are displayed

Click on the components to See more detail

Rack firmware table below



Rack	Alert Description	Value	Alert Start Date/Time
CRUSH-ATLHI	Front Door Sensor	1	Sun Jan 25 09:06:55 EST 2015
CRUSH-ATLHI	Humidity Sensor	15.58	Sun Jan 25 09:06:55 EST 2015
CRUSH-ATLHI	Cell#6 DC Power	1	Sun Jan 25 09:07:00 EST 2015
CRUSH-ATLHI	Cell#8 DC Power	1	Sun Jan 25 09:07:00 EST 2015
CRUSH-ATLHI	APM PM2 XML ERROR : Error: Ursa Major is not present.	0001	Sun Jan 25 09:07:00 EST 2015
CRUSH-ATLHI	APM RECT2 XML ERROR : Error: Ursa Major is not present.	0001	Sun Jan 25 09:07:00 EST 2015
CRUSH-ATLLO	Leak Detector #2	1	Sun Jan 25 09:06:55 EST 2015
CRUSH-ATLLO	Humidity Sensor	15.18	Sun Jan 25 09:06:55 EST 2015
CRUSH-ATLLO	Cell#2 DC Power	1	Sun Jan 25 09:07:00 EST 2015
Dory-ATLHI	Humidity Sensor	14.26	Sun Jan 25 09:06:55 EST 2015
Dory-ATLLO	APM PM1 XML ERROR : Error: Ursa Major is not present.	0001	Sun Jan 25 09:06:55 EST 2015
Dory-ATLLO	APM RECT1 XML ERROR : Error: Ursa Major is not present.	0001	Sun Jan 25 09:06:55 EST 2015
Flakey	pLAN Communications Alarm	1	Sun Jan 25 09:06:55 EST 2015
Flakey	Facility Isolation Return Valve Is Closed	1	Sun Jan 25 09:06:55 EST 2015
Flakey2	pLAN Communications Offline	1	Sun Jan 25 09:06:55 EST 2015
Flakey2	pLAN Communications Alarm	1	Sun Jan 25 09:06:55 EST 2015
Flakey2	Facility Isolation Return Valve Is Closed	1	Sun Jan 25 09:06:55 EST 2015
Flakey3	pLAN Communications Alarm	1	Sun Jan 25 09:06:55 EST 2015
Flakey3	Facility Isolation Return Valve Is Closed	1	Sun Jan 25 09:06:55 EST 2015
Squirt	pLAN Communications Offline	1	Sun Jan 25 09:06:55 EST 2015
Squirt	pLAN Communications Alarm	1	Sun Jan 25 09:06:55 EST 2015
Squirt	Facility Isolation Return Valve Is Closed	1	Sun Jan 25 09:06:55 EST 2015
Squirt	Front Door Sensor	1	Sun Jan 25 09:06:55 EST 2015
Squirt	Back Door Sensor	1	Sun Jan 25 09:06:55 EST 2015
Squirt	Humidity Sensor	16.04	Sun Jan 25 09:06:55 EST 2015
Squirt	HEX Fan DC Power Supply #1	2	Sun Jan 25 09:06:55 EST 2015
Squirt	Emergency Power Off Signal	1	Sun Jan 25 09:06:55 EST 2015

Rack	APM Firmware Version	APM Firmware Date	iCDU Software Version
CRUSH-ATL	2.10	Dec 3 2014	N/A
Dory-ATL	2.10	Dec 3 2014	N/A
Flakey	2.10	Dec 3 2014	3.00
Flakey3	2.10	Dec 3 2014	3.00
RACK10	2.10	Dec 3 2014	N/A
Squirt	2.10	Dec 3 2014	2.00

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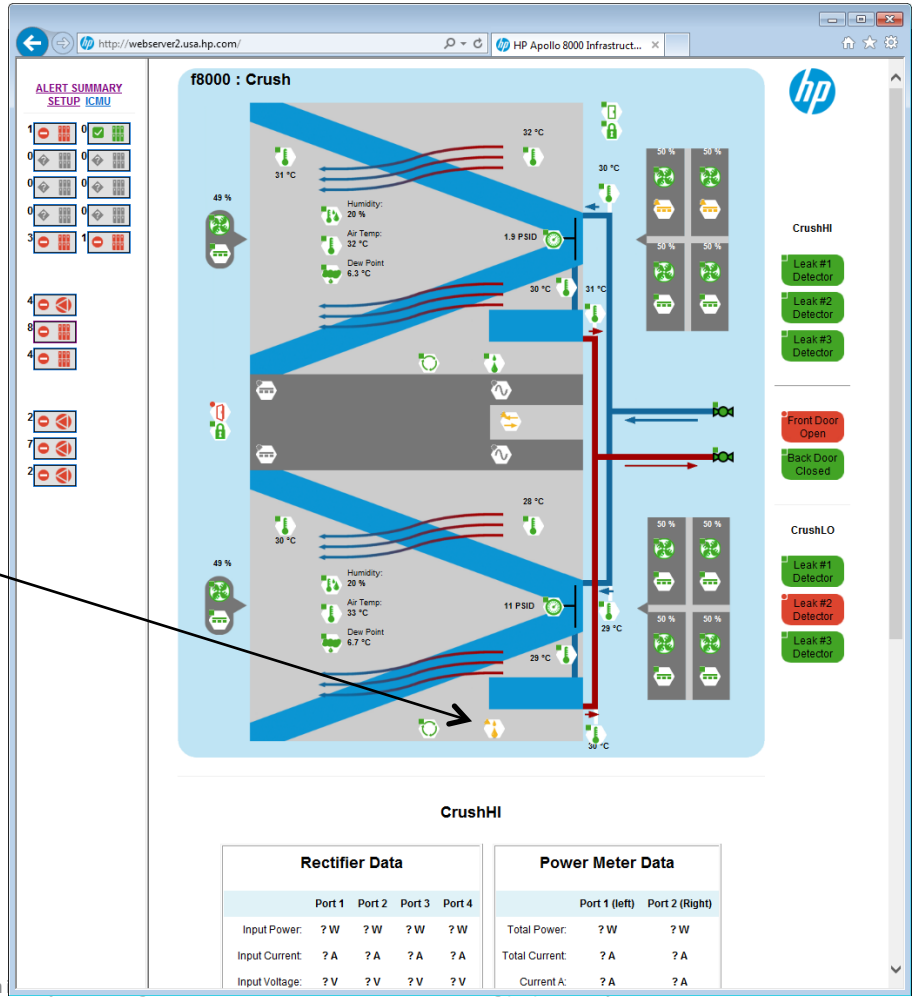
IT Rack schematic display

Icons representing sensors change color when values go out of range or an alert is triggered



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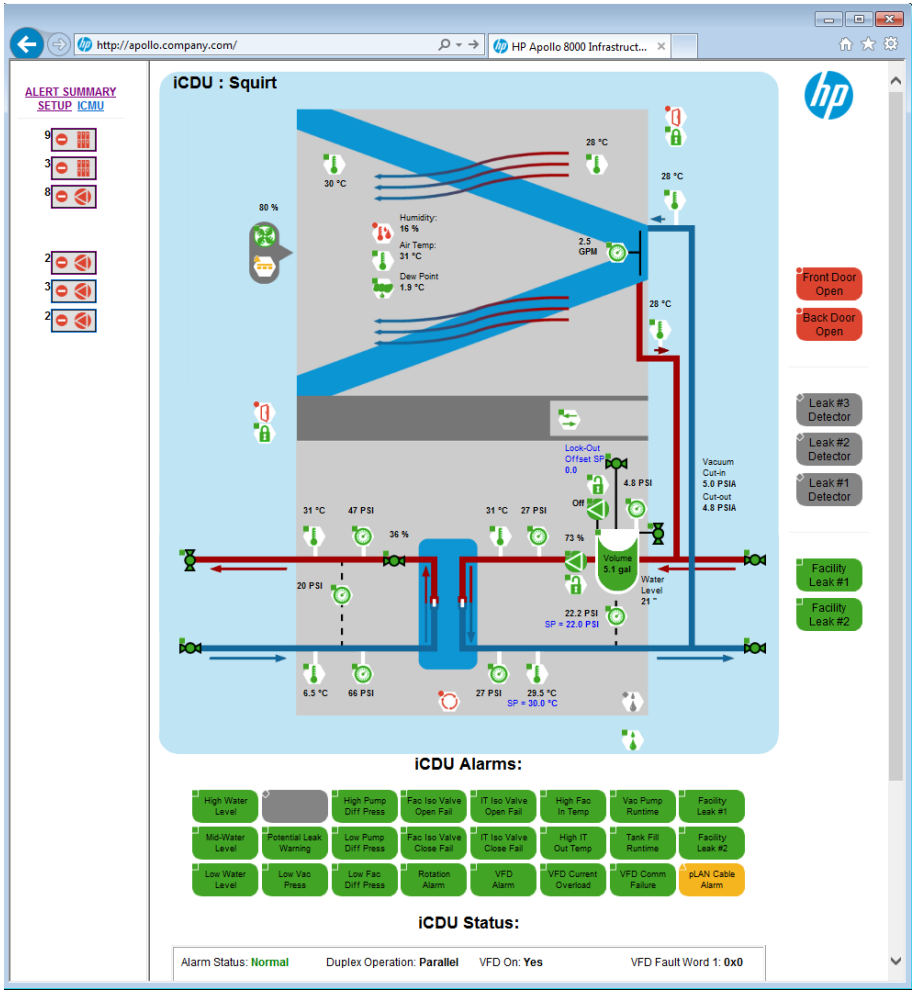
CDU Rack schematic display

Icons representing sensors change color when values go out of range or an alert is triggered

CDU Status and alarm table displayed below



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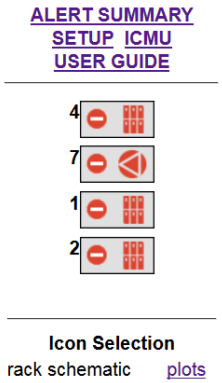
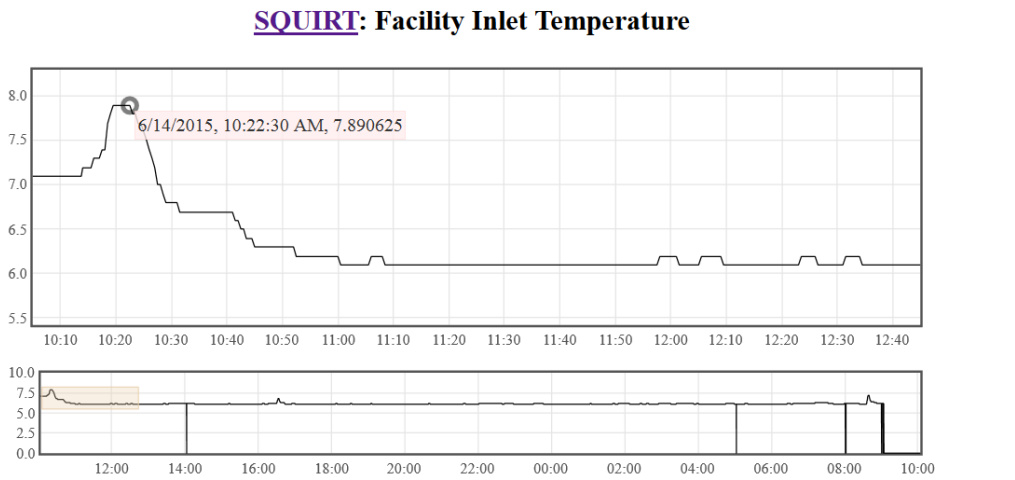
Plots spanning the past 24 hours for pre-selected metrics are available





*Facility Inlet Temperature | Facility Outlet Temperature | IT Pump Discharge Temperature

IT Heat Exchanger Outlet Temperature | Air Inlet Valve Is On | CDU Differential Pressure

Reservoir Pressure | VFD Frequency | VFD Speed

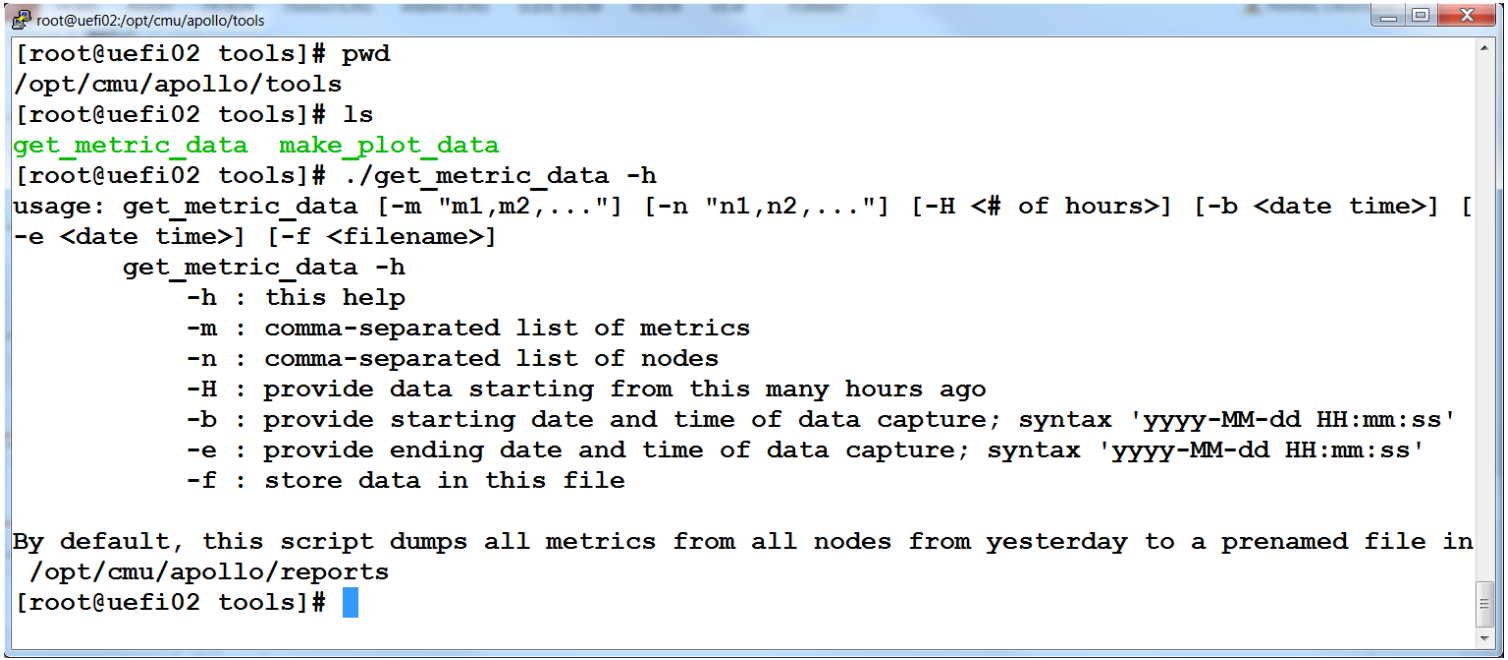
Central Air Temperature Sensor | Front Air Temperature Sensor | Back Air Temperature Sensor

Supply Water Temperature Sensor | Return Water Temperature Sensor

Use mouse to select region in either graph (upper detail graph or lower full graph) to view in detail graph.

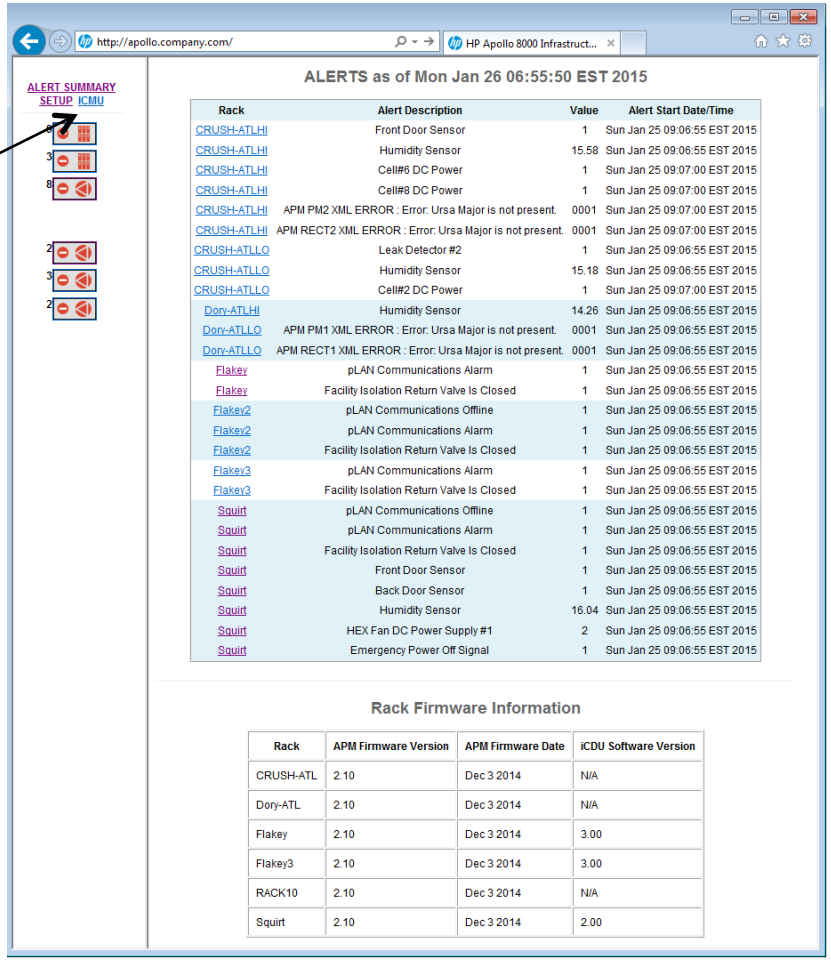
HP System Manager

- Every bit of metric data is preserved in the HP Insight CMU database
- Any and all data can be extracted to CSV files



HP System Manager

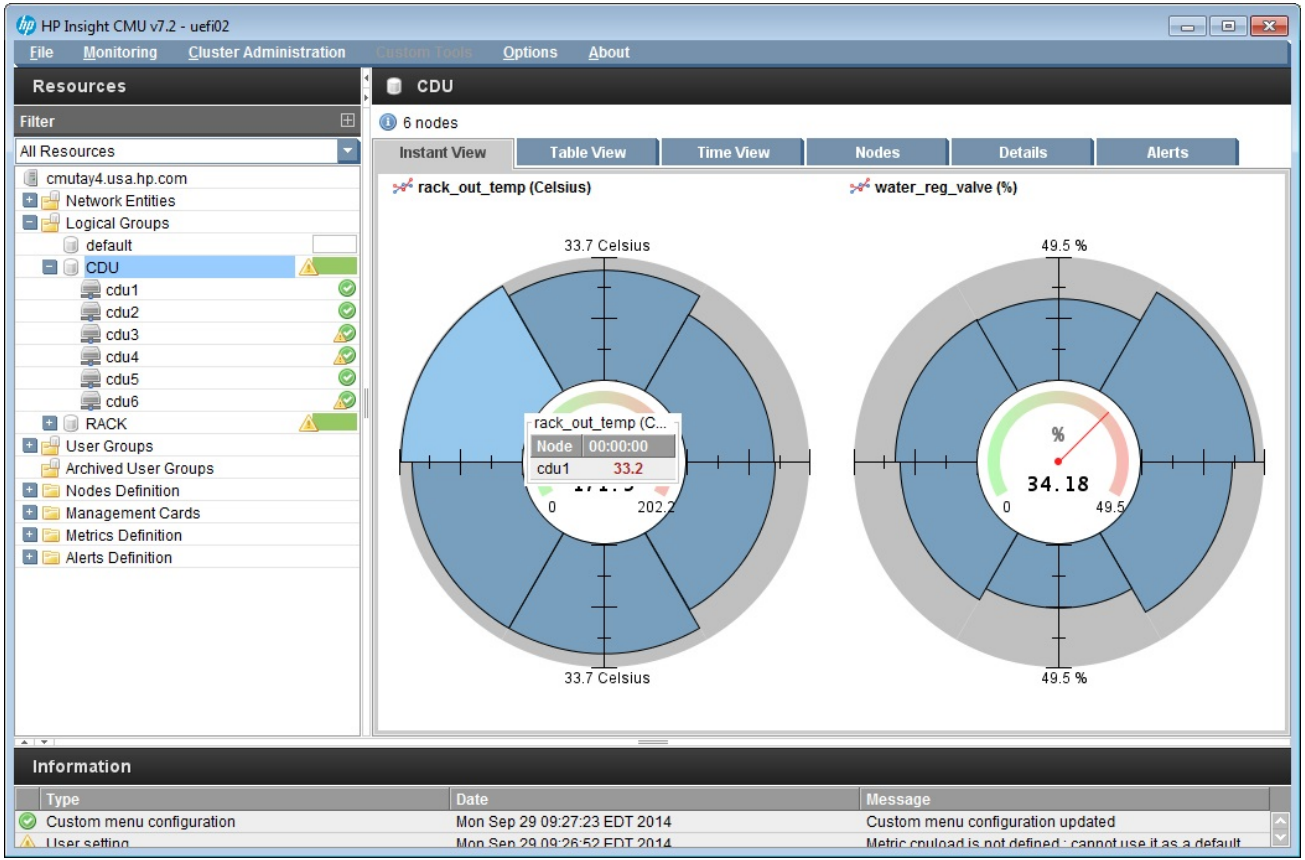
To view/analyze sensor history, use HP Insight CMU



HP System Manager

Each circle displays the given metric from all components so that the values can be compared to each other.

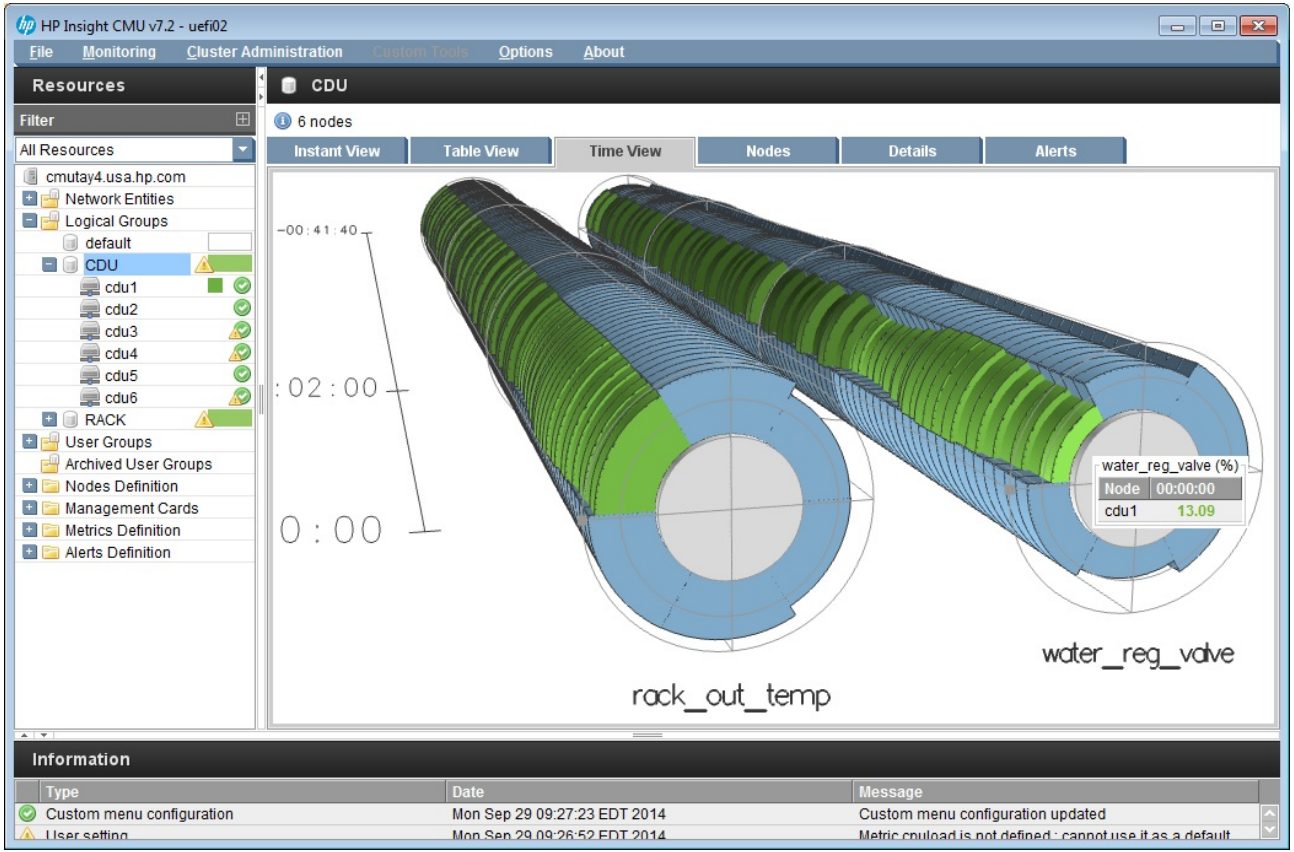
This display makes it easy to identify outliers (etc. hottest/coolest/ fastest/slowest component)



HP System Manager

HP Insight CMU Time View displays the same metric “circles” with history, so that patterns in the data can be seen.

You can click on the component slices to change their color so you can correlate the component across the circles



Thanks

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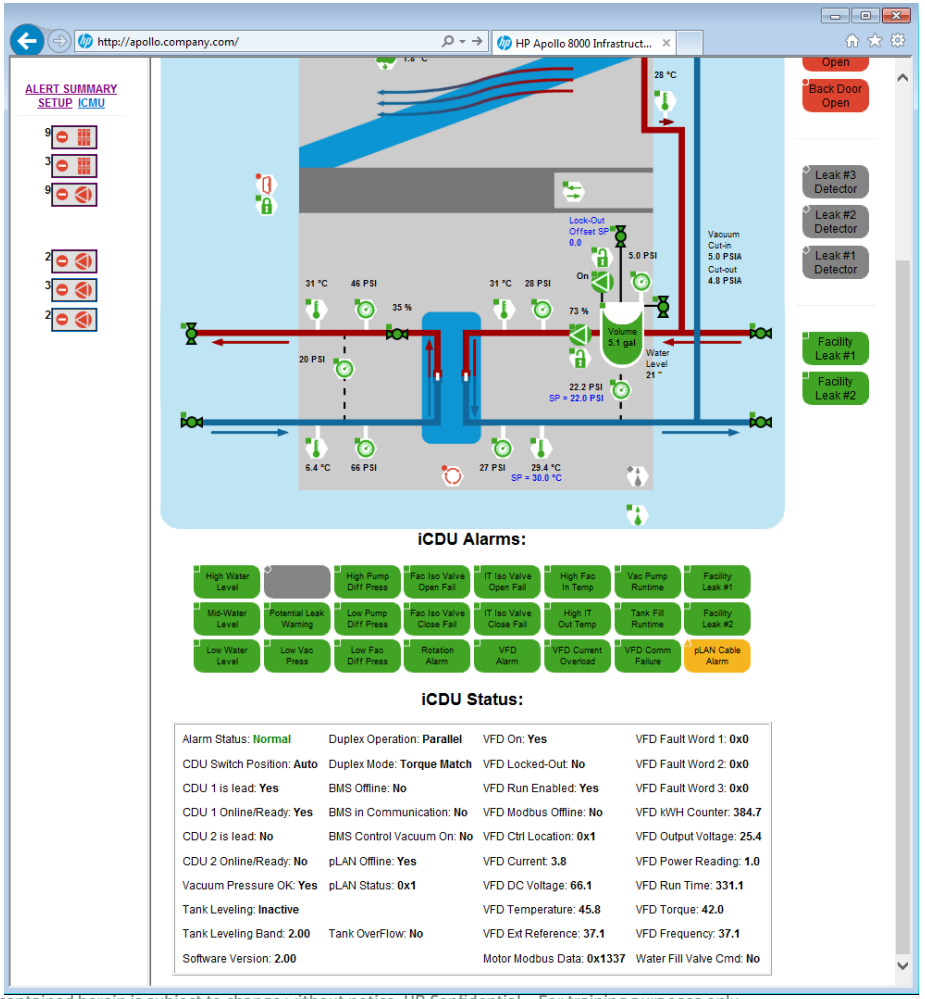
http://www.hp.com/go/apollo

Backup slides

HP System Manager

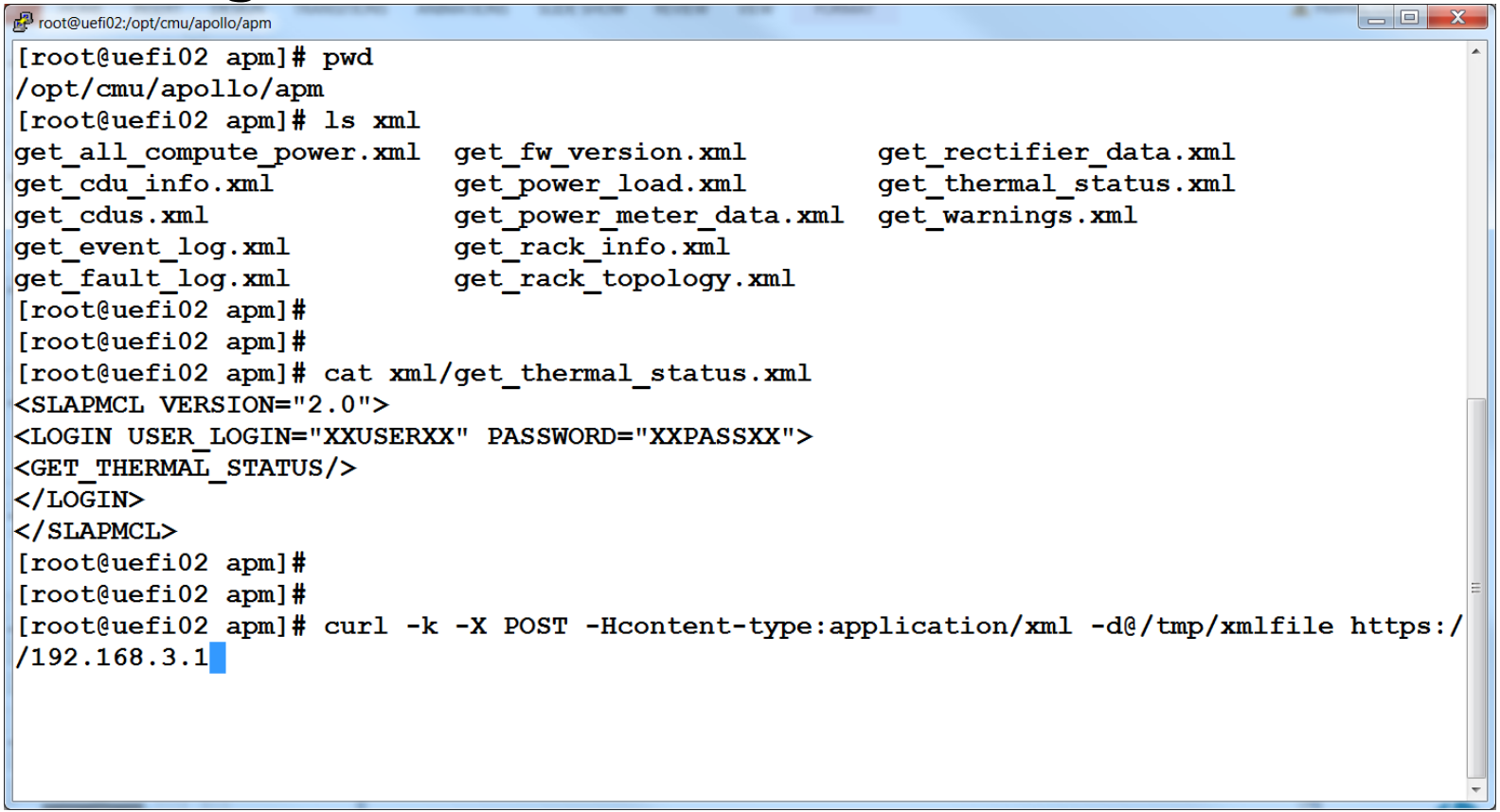


HP System Manager Pre-Configuration Requirements

- **Each HP APM configured with known IP address and username/password**
- **HP APM in CDU rack is configured with CDU IP address**
- **HP APM has secure XML enabled ('enable xml secure')**

- **System Manager server configured with appropriate IP addresses**
  - One internal IP address on "infrastructure" network connected to APMs
  - One external IP address connected to lab network

Gathering the data from APM



Gathering data from the APM

root@uefi02:/opt/cmu/apollo/apm

```
<SLAPMCL VERSION="1.00" >
<RESPONSE STATUS="0000" MESSAGE="No Error." />
<GET_THERMAL_STATUS>
<GET_THERMAL_STATUS_UPPER>
<SENSORS>
<SENSOR NAME="Leak Detector" INDEX="1" STATUS="no leaks" />
<SENSOR NAME="Leak Detector" INDEX="2" STATUS="no leaks" />
<SENSOR NAME="Leak Detector" INDEX="3" STATUS="no leaks" />
<SENSOR NAME="Door Sensor" INDEX="1" STATUS="closed ( front )" />
<SENSOR NAME="Door Sensor" INDEX="2" STATUS="closed ( rear )" />
<SENSOR NAME="Valve Sensor" INDEX="1" STATUS="not present" />
<SENSOR NAME="Valve Sensor" INDEX="2" STATUS="not present" />
<SENSOR NAME="Water Temp (RTD)" INDEX="1" STATUS="29.7425 degC ( supply )" />
<SENSOR NAME="Water Temp (RTD)" INDEX="2" STATUS="30.4925 degC ( intermediate )" />
<SENSOR NAME="Water Temp (RTD)" INDEX="3" STATUS="31.5863 degC ( return -bot )" />
<SENSOR NAME="Flow" INDEX="1" STATUS="1.92560 PSI (689.00 mV reading)" />
<SENSOR NAME="Temp-Humid -board" INDEX="1" STATUS="32.03 degC,  22.46 %RH" />
<SENSOR NAME="Dew Point Temp." INDEX="1" STATUS="7.93 degC" />
<SENSOR NAME="Air Temp." INDEX="1" STATUS="30.7500 degC (Dev 0:0 )" />
<SENSOR NAME="Air Temp." INDEX="7" STATUS="33.2500 degC (Dev 2:0 )" />
<SENSOR NAME="DC/DC Power Supply" INDEX="1" STATUS="654.00 mV (PS 0 - present - OK)" />
<SENSOR NAME="DC/DC Power Supply" INDEX="2" STATUS="655.00 mV (PS 1 - present - OK)" />
</SENSORS>
<CONTROLS>
```